Metal Halide Lamp Ballasts
Test Procedure NOPR Public Meeting

Building Technologies Program
Office of Energy Efficiency and Renewable Energy
U.S. Department of Energy

Friday December 19, 2008
Washington, DC

http://www1.eere.energy.gov/buildings/appliance_standards/commercial/metal_halide_lamp_ballasts.html

Welcome

- Introductions
- Role of the Facilitator
- Ground Rules (norms)
  - Listen as an ally
  - Use short, succinct statements/keep to the point
  - Hold sidebar conversations outside the room
  - Focus on issues, not personalities
  - One person speak at a time (raise hand to be recognized; state your name for the record)
  - Set cell phones to silent/vibrate
- Housekeeping Items
- Agenda Review
- Opening Remarks

Agenda

9:00 – 9:30 am	Welcome, Introductions, Opening Statements
9:30 – 10:20 am	Statute and Context
10:20 – 11:00 am	Proposed Ballast Efficiency Test Method
11:00 – 11:15 am	Break
11:15 – 12:00 pm	Standby and Off Mode Test Method
12:00 – 12:15 pm	Reporting Requirements
12:15 – 12:30 pm	Conclusion and Closing Remarks
12:30 pm	Adjourn

Purpose of the Public Meeting

- **Review statute and DOE actions for metal halide (MH) ballasts**
  - Test procedure based on ANSI Standard C82.6-2005
  - Standby and off mode
- **Present DOE's proposed test procedure and reporting requirements**
- **Clarify any questions about the proposal**
- **Seek comment from participants on the test procedure**
- **Discuss next steps for the rulemaking**

Issues for Comment

Issue Box DOE welcomes comments, data, and information concerning the proposed MH lamp ballast test procedure. Throughout this presentation issues that correspond to issues from the NOPR will be raised for discussion in boxes like this one. The issue box number corresponds to the numbered issue in Section IV of the NOPR. Nonetheless, comments are welcome on any part of DOE's proposal.

Public Meeting Agenda

1. Statute and Context
2. Proposed Ballast Efficiency Test Method
3. Standby and Off Mode Test Method
4. Reporting Requirements
5. Closing Remarks

Metal Halide Lamp Ballast Test Procedure

- **Section 324(c) of the Energy Independence and Security Act of 2007 (EISA 2007) amended EPCA to require that DOE establish test procedures for metal halide lamp ballasts:**

  "(18) METAL HALIDE LAMP BALLASTS. – Test procedures for metal halide lamp ballasts shall be based on ANSI Standard C82.6–2005, entitled 'Ballasts for High-Intensity Discharge Lamps—Method of Measurement'." (42 U.S.C. 6293(b)(18))

Minimum Ballast Efficiency Standards for MH Lamp Fixtures Effective January 1, 2009 [1]

MH Ballast Type 150W ≤ Lamp ≤ 500W	Minimum Ballast Efficiency
Pulse-start	88%
Magnetic Probe-start	94%
Nonpulse-start electronic ≤ 250 Watts	90%
Nonpulse-start electronic > 250 Watts	92%

[1] Section 324(e) of EISA 2007 amended section 325 of EPCA to prescribe minimum efficiency levels for certain MH ballasts incorporated into MH lamp fixtures. (42 U.S.C. 6295(hh)(1)(A))

Standards for Ballast Efficiency for Metal Halide Lamp Fixtures Effective January 1, 2009 [1]

Exempted fixtures:

1. Fixtures with regulated-lag ballasts,
2. Fixtures that use electronic ballasts that operate at 480V; or
3. Fixtures that:
   - i. are rated only for 150 watt lamps;
   - ii. are rated for use in wet locations, as specified by the National Electrical Code 2002, section 410.4(A); and
   - iii. contain a ballast that is rated to operate at ambient air temperatures above 50°C, as specified by UL 1029-2001.

[1] Section 324(e) of EISA 2007 amended section 325 of EPCA to prescribe minimum efficiency levels for certain MH ballasts incorporated into MH lamp fixtures. (42 U.S.C. 6295(hh)(1)(A))

MH Lamp Ballast Test Procedure Schedule

Dec. 5, 2008
Ballasts TP
NOPR Issued

75 Day Comment Period
Starting with publication in the Federal Register

June 30, 2009
Metal Halide Ballasts
Test Procedure
Final Rule

Public Meeting Agenda

1. Statute and Context
2. **Proposed Ballast Efficiency Test Method**
3. Standby and Off Mode Test Method
4. Reporting Requirements
5. Closing Remarks

Proposed MH Ballast Efficiency Test Procedure

1. Test Setup and Conditions

- (a) Lamp Orientation
- (b) Power Supply, Ambient Test Temperatures, and Instrumentation
- (c) Lamp Stabilization

2. Test Measurements / Calculation

Proposed Test Procedure

Lamp Orientation

1. Lamp orientation – vertical, base-up orientation

   DOE proposes lamp orientation for testing as specified in section 4.3 of ANSI Standard C82.6-2005

   – Most common in the industry

   – Most stable lamp operation leading to most repeatable and accurate results

2. Lamp orientation – horizontal

   ANSI Standard C82.6-2005 references section 3.6 of ANSI Standard C78.389-2004, “Lamp Position”

   – Addressed in ANSI Standards, but does not lead to accurate and repeatable results

   DOE is proposing to test in a vertical, base-up orientation.

Request for Comment

Item 4 The Department invites comment on the appropriateness of the lamp orientation requirements as specified in section 4.3 of ANSI Standard C82.6-2005 that require vertical base up unless the manufacturer specifies another orientation for that ballast and associated lamp combination. The Department also seeks comment on whether a preferred lamp orientation approach exists within the industry for lamp ballast testing. See section III.C.1. in the NOPR for a discussion for the proposed lamp orientation requirements.

Proposed MH Ballast Efficiency Test Procedure

1. Test Setup and Conditions
   - (a) Lamp Orientation
   - **(b) Power Supply, Ambient Test Temperatures, and Instrumentation**
   - (c) Lamp Stabilization
2. Test Measurements / Calculation

Proposed Test Procedure

Power Supply

DOE proposes power supply characteristics as specified in section 4.1 of ANSI Standard C82.6-2005

Section 4.1 of ANSI Standard C82.6-2005 requires:

1. The Root Mean Square (RMS) summation of harmonic components in the power supply be no more 3% of the fundamental voltage and frequency components
2. Impedance of the power source be no more than 3% of the specified ballast impedance
3. Power supply devices used in the test circuits have a power rating at least 5x the wattage of the lamp intended to operate on the ballast under test

Proposed Test Procedure

Ambient Test Temperature

DOE proposes ambient test temperatures as specified in section 4.2 of ANSI Standard C82.6-2005

Section 4.2 in ANSI Standard C82.6-2005 requires:

1. Maintenance of an ambient temperature of 25° ± 5° *C* to reduce potential ballast operating variances caused by excessive temperature

DOE further proposes tests be conducted in a draft-free environment

Request for Comment

Item 1 The Department invites comment and data on the applicability of the proposed ambient test temperature requirements, based on section 4.2 in ANSI Standard C82.6-2005. In particular, DOE is interested in comment on whether a different set of ambient test conditions might be more appropriate for metal halide ballast testing. See section III.C.1 in the NOPR for a discussion of the proposed ambient temperature conditions.

Proposed Test Procedure

Instrumentation (Digital)

DOE proposes using the instrumentation prescribed in sections 4.5.1 and 4.5.3 of ANSI Standard C82.6-2005

ANSI requirements for digital voltmeters, ammeters, and wattmeters:

1. Resolution of three and one-half digits
2. Minimum accuracy of 0.50% of the reading from actual with true RMS capability

Proposed Test Procedure

Instrumentation (Analog)

DOE proposes using the instrumentation prescribed in sections 4.5.1 and 4.5.3 of ANSI Standard C82.6-2005

Analog ammeters and voltmeters:

1. 0.50% up to 800 Hertz

Analog wattmeters:

1. 0.75% up to 1000 Hertz for ballasts with power factors 50% - 100%
2. 0.50% up to 125 Hertz for ballasts with power factors 0% - 20%

DOE proposes to require all analog wattmeters used on ballasts with power factors less than 50% to same accuracy as those for ballasts with power factors less than 20% (i.e., ±0.50 percent up to 125 Hertz).

Request for Comment

Item 2 The Department invites comment and data on the applicability of the proposed instrumentation requirements for power supplies, wattmeters, voltmeters, and ammeters required for testing, based on the requirements in section 4.0 of ANSI Standard C82.6-2005. See section III.C.1 in the NOPR for a discussion of the instrumentation requirements.

DOE especially invites comment on the issue of the applicability of the proposed measurement accuracy ±0.50 percent up to 125 Hertz for ballasts with power factors between 20 and 50 percent, because ANSI Standard C82.6-2005 does not provide an accuracy value for the proposed instrumentation for these power factors. See section III.C.1 in the NOPR for a discussion of the proposed instrumentation requirements.

Proposed Test Procedure

Circuit Connection

DOE proposes that only one analog instrument may be connected to the test circuit at one time to reduce impedance effects on the testing

DOE believes that all these instrumentation requirements, as set forth in ANSI Standard C86.5-2005, would facilitate repeatable and consistent testing and measurement.

Request for Comment

Item 3 The Department invites comment on the applicability of the proposed test circuit connection requirements, based on sections 4.5 and 6.10 of ANSI Standard C82.6-2005. See section III.C.1 in the NOPR for a discussion of the proposed test circuit connections.

Proposed MH Ballast Efficiency Test Procedure

1. Test Setup and Conditions
   - (a) Lamp Orientation
   - (b) Power Supply, Ambient Test Temperatures, and Instrumentation
   - **(c) Lamp Stabilization**
2. Test Measurement / Calculation

Proposed Test Procedure

Lamp Stabilization

DOE proposes the process for lamp stabilization that would follow section 4.4 of ANSI Standard C82.6-2005.

4.4.1 The lamps used for ballast measurements, shall unless otherwise specified, have been seasoned a minimum of 100 hours prior to their use in the ballast tests.

Proposed Test Procedure

Lamp Stabilization

4.4.2 Basic stabilization method:

- Operate lamp ±3% of rated wattage in an ambient temperature of 25°C ± 5°C until electrical parameters of the lamp cease to change
- Lamp burning time required to achieve stabilization is a minimum of 30 minutes – could be 6 hours or more for MH lamps
- Standby ballast recommended to warm up the lamp to prevent moving the lamp
- Once the lamp has been transferred to the test ballast circuit, re-stabilization time is important – to avoid test ballast heat-up, measurements should be taken within 5 minutes after re-stabilization

Proposed Test Procedure

Lamp Stabilization per ANSI Standard C82.6-2005

4.4.3 Alternative Stabilization Method:

- In some cases, such as low frequency electronic ballasts, the transfer from the reference ballast to the ballast under test is undefined, the following alternative method should be followed to ensure testing result reproducibility:
- Lamp characteristics should be determined with a reference ballast and recorded for future comparison
- The same lamp will be driven by the ballast under test for 15 minutes.
- The electrical measurements should be taken within 2 minutes after the 15-minute stabilization period.

Request for Comment

Item 5 The Department invites comment and data on the applicability of the proposed lamp seasoning and system stabilization requirements that follow the ANSI Standard C82.6-2005 requirement for a 100-hour seasoning period and the stabilization method in either section 4.4.2 or 4.4.3 of ANSI Standard C82.6-2005, with additional methods from ANSI Standard C78.389-2004.

DOE is particularly interested in whether a preferred lamp seasoning or lamp stabilization approach exists within the industry. See section III.C.1 in the NOPR for a discussion of the proposed lamp seasoning and system stabilization conditions.

Proposed MH Ballast Efficiency Test Procedure

1. Test Setup and Conditions
   - (a) Lamp Orientation
   - (b) Power Supply, Ambient Test Temperatures, and Instrumentation
   - (c) Lamp Stabilization
2. **Test Measurement / Calculation**

Proposed Test Procedure

Calculation:

- EISA defines Ballast Efficiency[1] as:
  - Measured output power to the lamp divided by the measured input power (P_{out}/P_{in}).

DOE proposes that the ballast efficiency be calculated as the measured output power to the lamp divided by the measured input power to the ballast (P_{out}/P_{in})

- Test measurements for metal halide ballasts would require that ballast operating testing be conducted according to the same requirements as set forth in section 6.10, “Ballast Power Loss,” of ANSI Standard 82.6-2005.

[1] (42 U.S.C. 6295(hh)(1))

Request for Comment

Item 6 The Department invites comment and data on the applicability of the proposed measurement of ballast power losses in accordance with section 6.10 of ANSI Standard C82.6-2005, which requires the use of a true RMS wattmeter with basic accuracy of 0.50 percent. DOE is particularly interested in whether a preferred ballast power-loss measurement approach exists within the industry for metal halide lamps. See section III.C.2 in the NOPR for a discussion of the proposed testing measurements.

Public Meeting Agenda

1. Statute and Context
2. Proposed Ballast Efficiency Test Method
3. **Standby and Off Mode Test Method**
4. Reporting Requirements
5. Closing Remarks

Overview

- **EPCA, in relevant part, directs DOE to establish test procedures to include standby mode, "taking into consideration the most current versions of Standards 62301 and 62087 of the International Electrotechnical Commission"[1]**
  - IEC Standard 62087 applies to audio, video, and related equipment, but not to lighting equipment – thus not suitable to this rulemaking
  - DOE developed proposed rule consistent with procedures outlined in IEC Standard 62301 & reference language from ANSI Standard C82.6-2005

- EPCA defines three types of modes covering the various operating conditions of an energy-using product. The three modes are:
  1. Active Mode
  2. Standby Mode
  3. Off Mode

[1] (42 U.S.C. 6295(gg)(2)(A))

EPCA Defines "Active Mode"[1]

Active Mode is:

- The condition in which an energy-using product -
  1. is connected to a main power source;
  2. has been activated; and
  3. provides 1 or more main functions.

- When the MH ballast is operating the lamp, the ballast is in active mode. The ballast efficiency measure part of this test procedure covers this type of mode.

[1] EPCA (42 U.S.C. 6295(gg)(1)(A)(i))

EPCA defines "Standby Mode"[1]

- "Standby mode" is:

  "the condition in which an energy-using product

  (1) is connected to a main power source; and

  (2) offers one or more of the following user-oriented or protective functions:

  (aa) to facilitate the activation or deactivation of other functions (including active mode) by remote switch (including remote control), internal sensor, or timer;

  (bb) continuous functions, including information or status displays (including clocks) or sensor-based functions."

[1] (42 U.S.C. 6295(gg)(1)(A)(iii))

Standby Mode

Applicability of "Standby mode" to MH ballasts:

- The definition requires that ballasts be connected to their main power source; since most ballasts operated with on-off switches, circuit breakers, or other relays that disconnect the ballast from the main power source which precludes the majority of ballasts from having stand-by energy consumption.
- The vast majority of ballasts do not consume energy when they are switched off.
- ***DOE interprets this condition as applying to ballasts that are designed to operate in, or function as, a lighting control system where auxiliary control devices send signals.***

EPCA defines "Off Mode"[1]

- "Off mode" is:

  "the condition in which an energy-using product

  (1) is connected to a main power source; and

  (2) is not providing any standby or active mode function."

- DOE considered this definition in the context of metal halide ballasts and believes that off mode does not apply to any metal halide ballast, dimmable or non-dimmable, because off mode describes a condition that commercially available ballasts do not attain.

[1] (42 U.S.C. 6295 (gg)(1)(A)(ii))

Request for Comment

Item 7 The Department invites comment on its approach for assessing metal halide ballast operation in active mode, standby mode, and off mode, as those terms are defined in EPCA. In particular, DOE invites comment on its tentative conclusion that off mode does not apply to metal halide lamp ballasts at this time, and, therefore, should not be included as part of this proposed test procedure. See section III.B of the NOPR for a discussion of off mode.

Test Method and Measurements

The Department's proposed test procedure for measuring standby power consists of the following steps:

1. A signal is sent to the ballast instructing it to reduce light output to zero percent;
2. The main input power to ballast is measured;
3. The power from the control signal path is measured

Measurement: Input Power

- The measurement of input power to the ballast from the main electricity supply during standby mode is based on the approach in ANSI Standard C82.6-2005, section 6.
  - This measurement parallels the approach DOE is proposing for measuring the active mode power consumption for input power (watts) to the ballast in accordance with ANSI Standard C82.6-2005.
  - Thus the test measurements of ballast input power would be required to be conducted in accordance with the appropriate sections of the current industry test method.

Measurement: Ballast's Control Signal Power

- As proposed at 10 CFR 431.324(c), the proposed test procedure would direct manufacturers to address measurement of the ballast's control signal power.
- As DOE understands it, there are four possible ways to deliver a control signal to a metal halide lamp ballast:
  1. a dedicated AC control signal wire:
  2. a dedicated DC control signal wire:
  3. a PLC control signal over the main supply input wires;
  4. a wireless control signal
     - DOE estimates that the power supplied to a ballast using a wireless signal would be very small (well below 1.0 watt) – making it hard to measure and unlikely to appreciably impact ballast power

Proposed Definitions for Control Signals

- DOE proposes to define "AC control signal" as:

  "an alternating current (AC) signal that is supplied to the ballast using additional wiring for the purpose of controlling the ballast and putting the ballast in standby mode."

- DOE proposes to define "DC control signal" as:

  "a direct current (DC) signal that is supplied to the ballast using additional wiring for the purpose of controlling the ballast and putting the ballast in standby mode."

Proposed Definitions for Control Signals

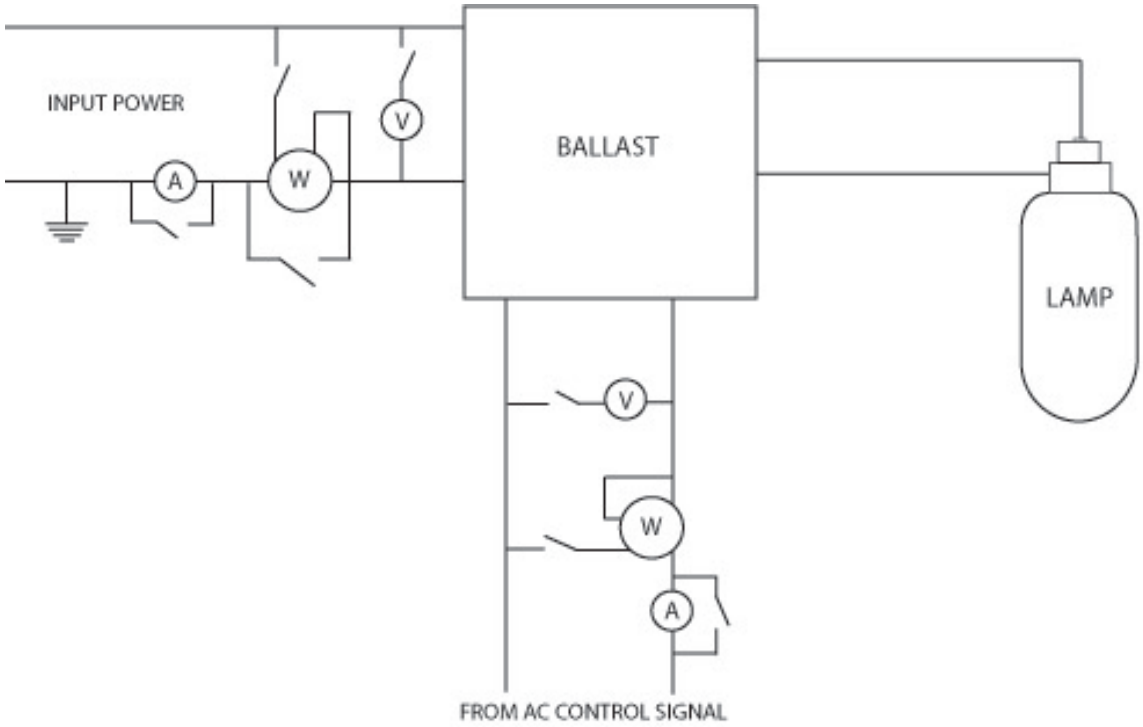
- DOE proposes to define "PLC control signal" as:

  "a power line carrier (PLC) signal that is supplied to the ballast using the input ballast wiring for the purpose of controlling the ballast and putting the ballast in standby mode."

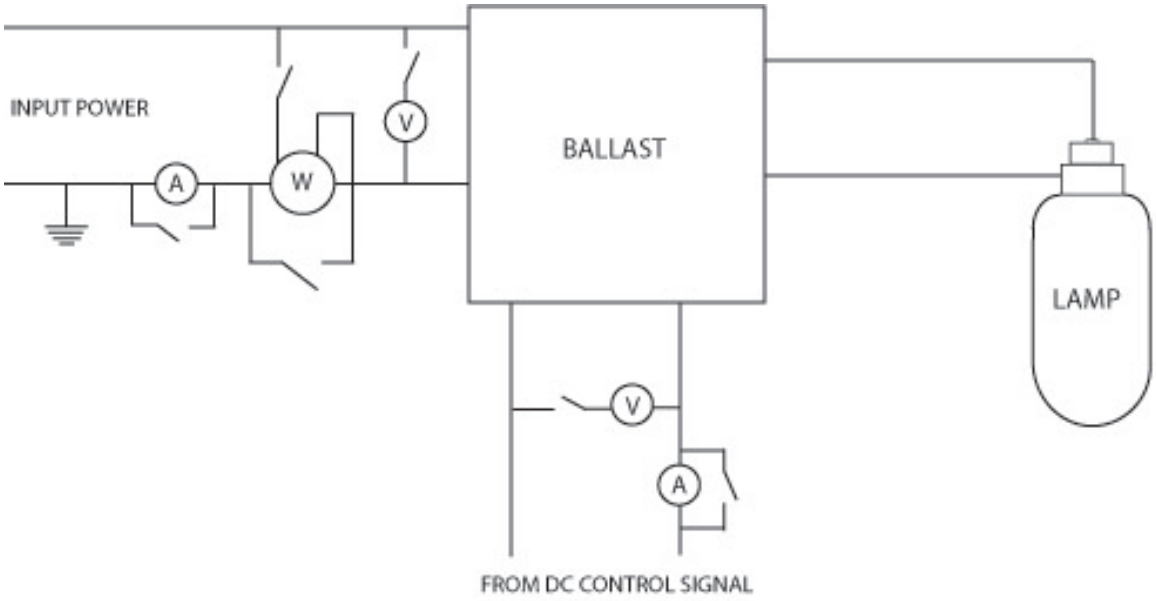
- DOE proposes to define "Wireless control signal" as:

  "a wireless signal that is radiated to and received by the ballast for the purpose of controlling the ballast and putting the ballast in standby mode."

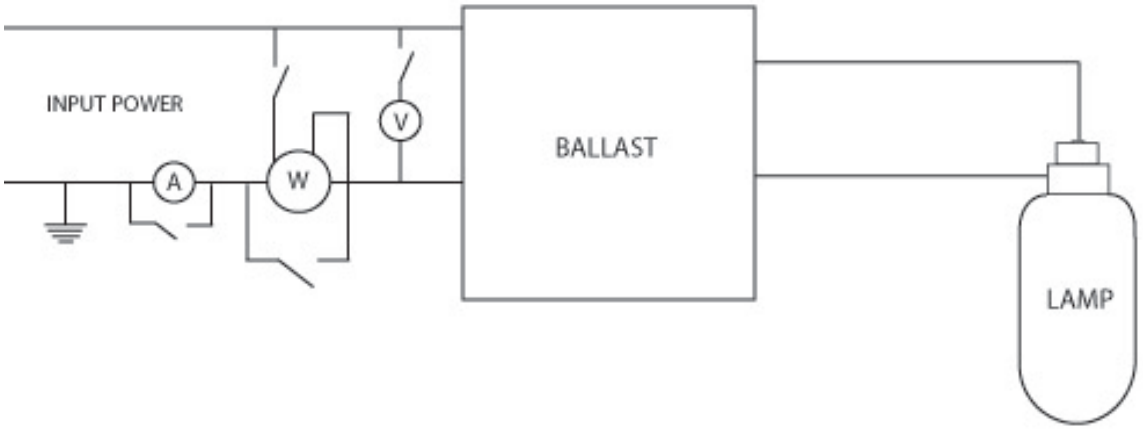
Proposed Test Setup for Measuring Standby Power of Metal Halide Ballasts with AC control signal



Proposed Test Setup for Measuring Standby Power of Metal Halide Ballasts with DC control signal



Proposed Test Setup for Measuring Standby Power of Metal Halide Ballasts with PLC control signal



Request for Comment

Item 8 The Department invites comment on its approach to apply the standby mode provisions of this test procedure to all metal halide lamp ballasts that incorporate some form of electronic circuit that enables the ballast to communicate with and be part of a lighting control system. Although all metal halide ballasts would be subject to the test procedure generally, only these types would be subject to the test procedure's standby mode power provisions. See section III.E of the NOPR for a discussion of the proposed scope of the test procedure's standby power provisions.

Request for Comment

Item 10 The Department invites comment on its proposed test method and measurements for metal halide lamp ballasts, which provide the step-by-step procedure and circuit diagrams necessary for measuring the power (in watts) by the main power input to the ballast, and the control signal wire (if any). See sections III.C and D of the NOPR for a discussion of the proposed circuit diagrams.

Combining Measurements and Burden

- DOE proposes that the test procedure would direct manufacturers to take two required measurements:
  1. The main input power
  2. Control signal power in standby mode

- The proposed test procedure does not tell manufacturers how to combine these values or use them in equations pertaining to energy efficiency
  - DOE intends to study how best to use these measurements of standby mode power in a separate rulemaking to review and possibly amend the energy conservation standards for metal halide lamp ballasts, which DOE is required to complete by January 1, 2012, pursuant to EISA 2007.

Combining Measurements and Burden

- DOE notes that the proposed test procedure is designed to produce results that measure standby power in an accurate and repeatable manner, and should not be unduly burdensome on manufacturers to conduct.

- DOE believes that these objectives would be met by the proposed test procedure, particularly given that it is based upon IEC Standard 62301 and follows testing approaches used in ANSI Standard C82.6-2005.

Public Meeting Agenda

1. Statute and Context
2. Proposed Ballast Efficiency Test Method
3. Standby and Off Mode Test Method
4. **Reporting Requirements**
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Units to be Tested: Sample Size

- DOE considered 4 factors in developing sample size requirements:
  1. providing a highly statistically valid probability that a basic model that is tested meets applicable energy conservation standards;
  2. providing a highly statistically valid probability that a manufacturer preliminarily found to be in noncompliance will actually be in noncompliance
  3. assuring compatibility with other sampling plans DOE has promulgated; and
  4. minimizing manufacturers' testing time and costs.

DOE Proposes a Definition for "Basic Model"

- DOE proposes a definition for "basic model":

  "with respect to metal halide ballasts, all units of a given type of metal halide ballast (or class thereof) that:

  (1) are rated to operate a given lamp type and wattage;

  (2) have essentially identical electrical characteristics; and

  (3) have no differing electrical, physical, or functional characteristics that affect energy consumption."

Request for Comment

Item 9 The Department invites comment on its definition for the following eight terms that DOE is proposing to add to 10 CFR part 431; AC control signal, active mode, basic model, DC control signal, off mode, PLC control signal, standby mode, and wireless control signal. See section III.B for a discussion of the proposed definitions.

Units to be Tested: Sample Size

- DOE considered 3 alternatives for the specification of test sample size for metal halide ballast equipment:
  1. test every unit to determine with 100% certainty that each one complies with statute;
  2. test a predetermined number of units to yield a high level of statistical confidence; and
  3. test until a determination can be made that a basic model does, or does not comply.

Units to be Tested: Sampling Procedure

- DOE proposes randomly selecting and testing a sample of production (not fewer than four) of a representative model:
  - a simple average of values would be calculated – becoming the actual mean value of the sample

- For each representative model, a sample of sufficient size, no less than four, would be selected at random and tested to ensure that the calculated value of energy efficiency is no less than:
  1. the lower of the mean of the sample; or
  2. the lower 99% confidence limit of the mean of the entire population of that basic model, divided by a coefficient applicable to the represented value.

Request for Comment

Item 11 The Department invites comment and data on the accuracy and applicability of the proposed sampling for metal halide ballasts. The Department seeks comment on whether an alternative sampling method exists that might be more appropriate for metal halide ballasts. See section III.G of the NOPR for a discussion of the proposed sampling size method.

Submission of Data

- DOE proposes that the manufacturer, or other entity conducting tests on behalf of the manufacturer, provide a certification report for each basic model which includes the following information:
  1. the equipment type;
  2. manufacturer's name;
  3. private labeler's name(s) (if applicable); and
  4. manufacturer's model number(s).
- The report would be required to certify that the testing was completed in accordance with the applicable test requirements prescribed in 42 U.S.C. 6293(b) of EPCA, as amended.

Request for Comment

Item 12 The Department invites comment on the potential impact of applying data requirements described in other DOE test procedures for products and equipment subject to energy conservation standards as it applies to metal halide ballasts. DOE seeks comment on whether an alternative set of submission requirements exists that might be more appropriate for metal halide ballasts. See section III.H of the NOPR for a discussion of the proposed submission of data requirements.

Enforcement Provisions

- Once a Federal energy conservation standard becomes effective for metal halide ballasts, the enforcement of the appropriate application of the testing procedure for this equipment would be subject to enforcement of the efficiency requirements and verification of the documented testing.
- DOE proposes to apply to metal halide ballasts the same basic requirements for enforcement currently in place for other lighting equipment.
- DOE will review the testing certification.

Enforcement Provisions

- If DOE receives written information about the performance of metal halide ballasts indicating that one or more basic models may not be in compliance with the energy conservation standard, DOE may conduct independent testing of those basic models.
- The results of this testing would serve as the basis for any enforcement actions related to the application of these metal halide ballast test procedures.

Request for Comment

Item 13 The Department invites comment on the potential impact of applying the enforcement provisions described in other DOE test procedures for products and equipment subject to energy conservation standards as they apply to metal halide ballasts. See section III.I of the NOPR for discussion of the proposed enforcement provisions.

Public Meeting Agenda

1. Statute and Context
2. Proposed Ballast Efficiency Test Method
3. Standby and Off Mode Test Method
4. Reporting Requirements
5. **Closing Remarks**

DOE Seeks Comments on its Proposal

In all correspondence, include all of the following:

- Test Procedures for Metal Halide Lamp Ballasts
- Docket Number EERE-2008-BT-TP-001
- Regulatory Identification Number (RIN) 1904-AB87

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Comment period closes: 75 days after publication in the Federal Register